Climate Change Adaptation Advisory Committee

Executive Office of Energy and Environmental Affairs

June 04, 2009

TOPICS

GWSA Overview

Global Trends

- Historical
- Current and Predicted
- Climate Change Impacts

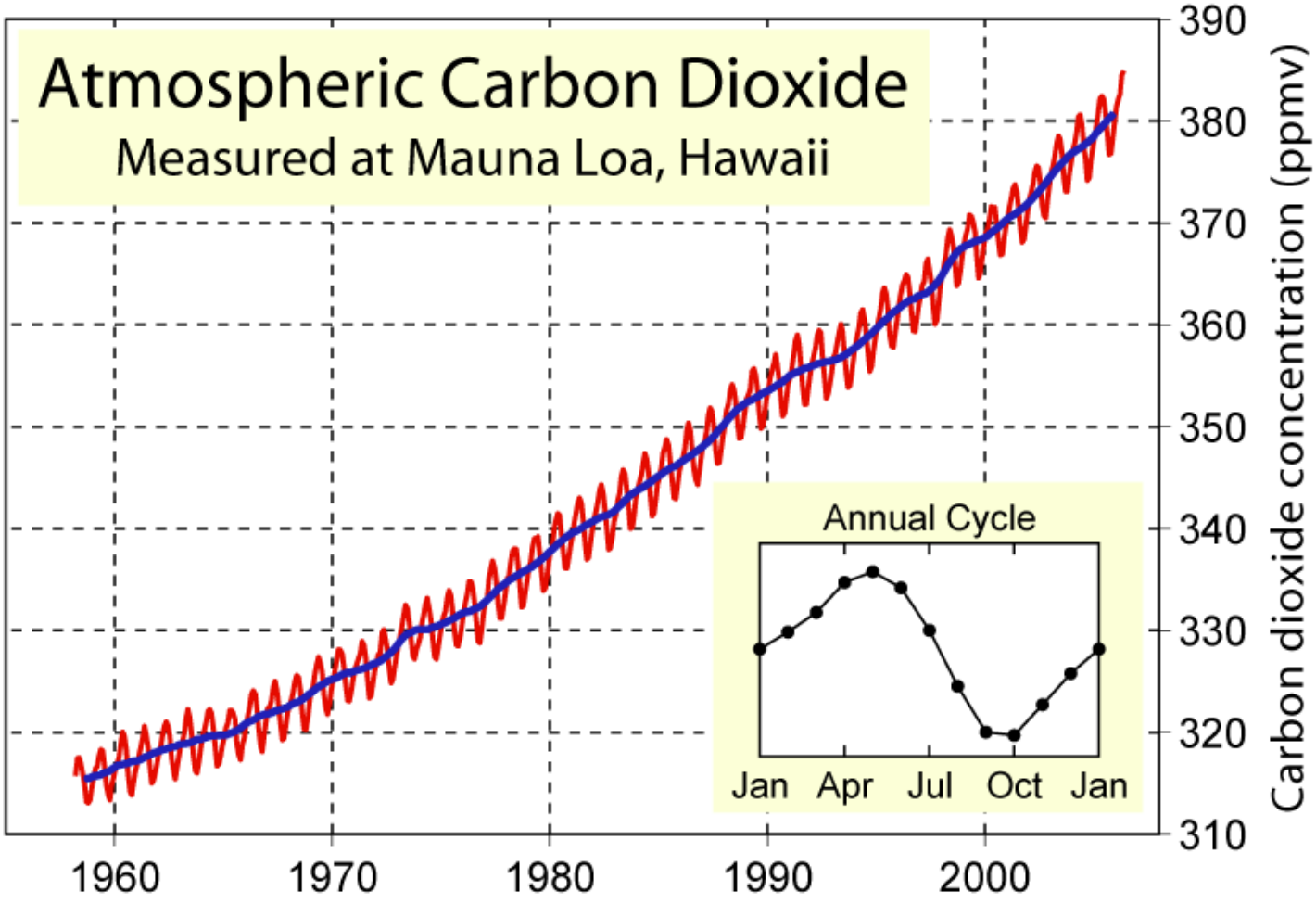
Northeast Specific

- Observations
- Predictions
- Climate Change Impacts: temp, sea level, precipitation

Global Warming Solutions Act

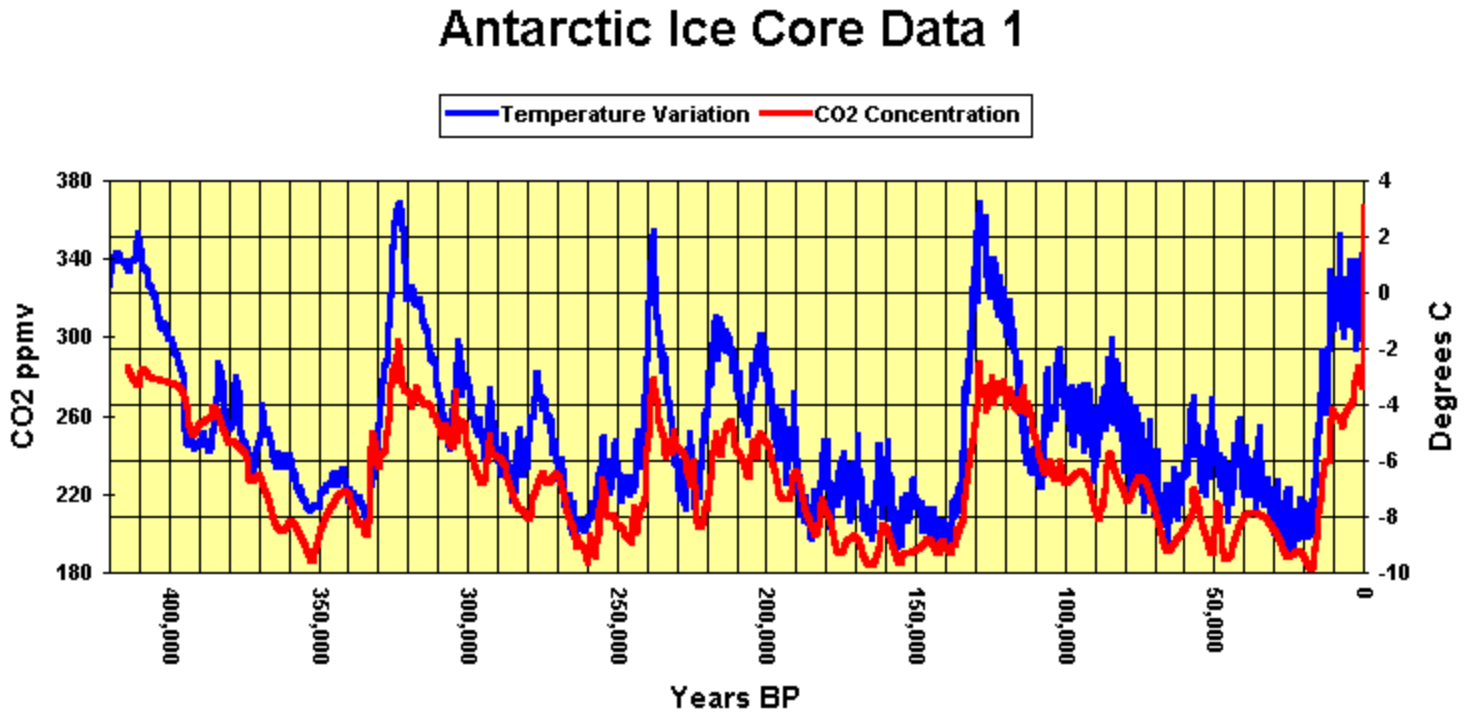
- Requires 10-25 % GHG emissions reduction below 1990 levels by 2020, economy-wide; 80% by 2050
- Develop Plans to Achieve Statewide Reductions
- Develop cost-effective approaches
- Create advisory committees on mitigation and adaptation

Concentrations of Atmospheric CO_2 are Increasing



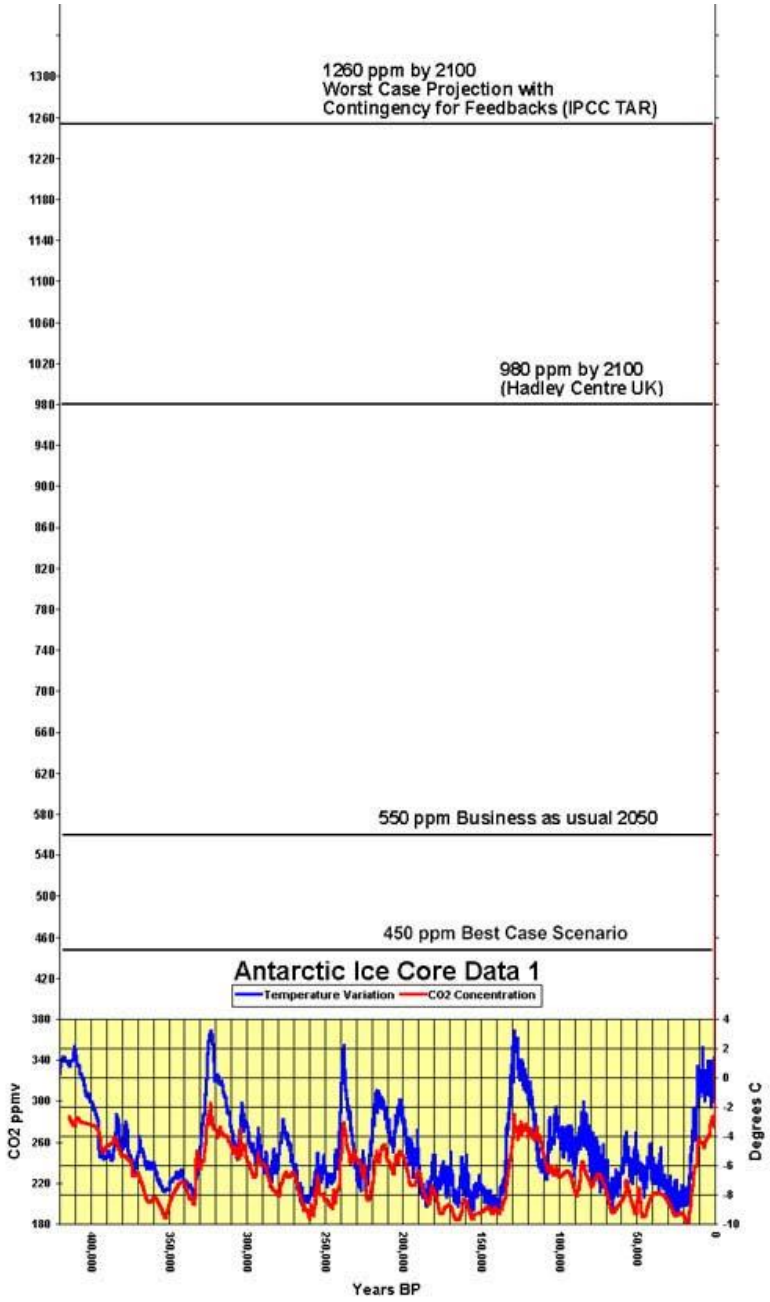
C.D. Keeling and T.P. Whorf (October 2004). "Atmospheric CO2 from Continuous Air Samples at Mauna Loa Observatory, Hawaii, U.S.A.". *Carbon Dioxide Information Analysis Center*, *Oak Ridge National Laboratory*. http://cdiac.ornl.gov/trends/co2/sio-keel-flask/sio-keel-flaskmlo_c.html.

Historical CO_2 and Temperature are Correlated

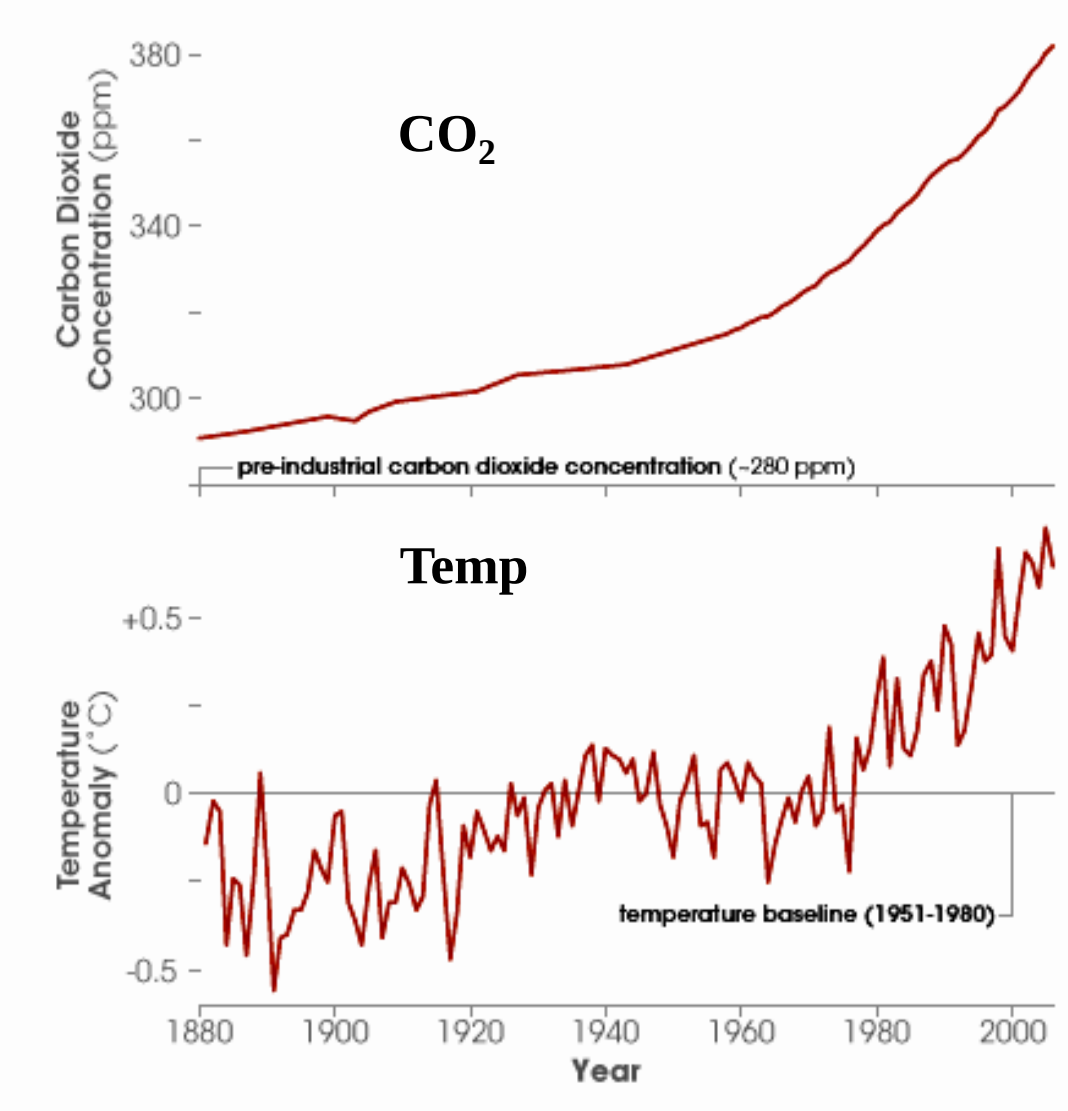


Based on: Climate and atmospheric history of the past 420,000 years from the Vostok ice core, Antarctica. 1999. Petit J.R., Jouzel J., Raynaud D., Barkov N.I., Barnola J.M., Basile I., Bender M., Chappellaz J., Davis J. Delaygue G., Delmotte M. Kotlyakov V.M., Legrand M., Lipenkov V.M., Lorius C., Pépin L., Ritz C., Saltzman E., Stievenard M. Nature 399: 429-436.

We are entering uncharted territory

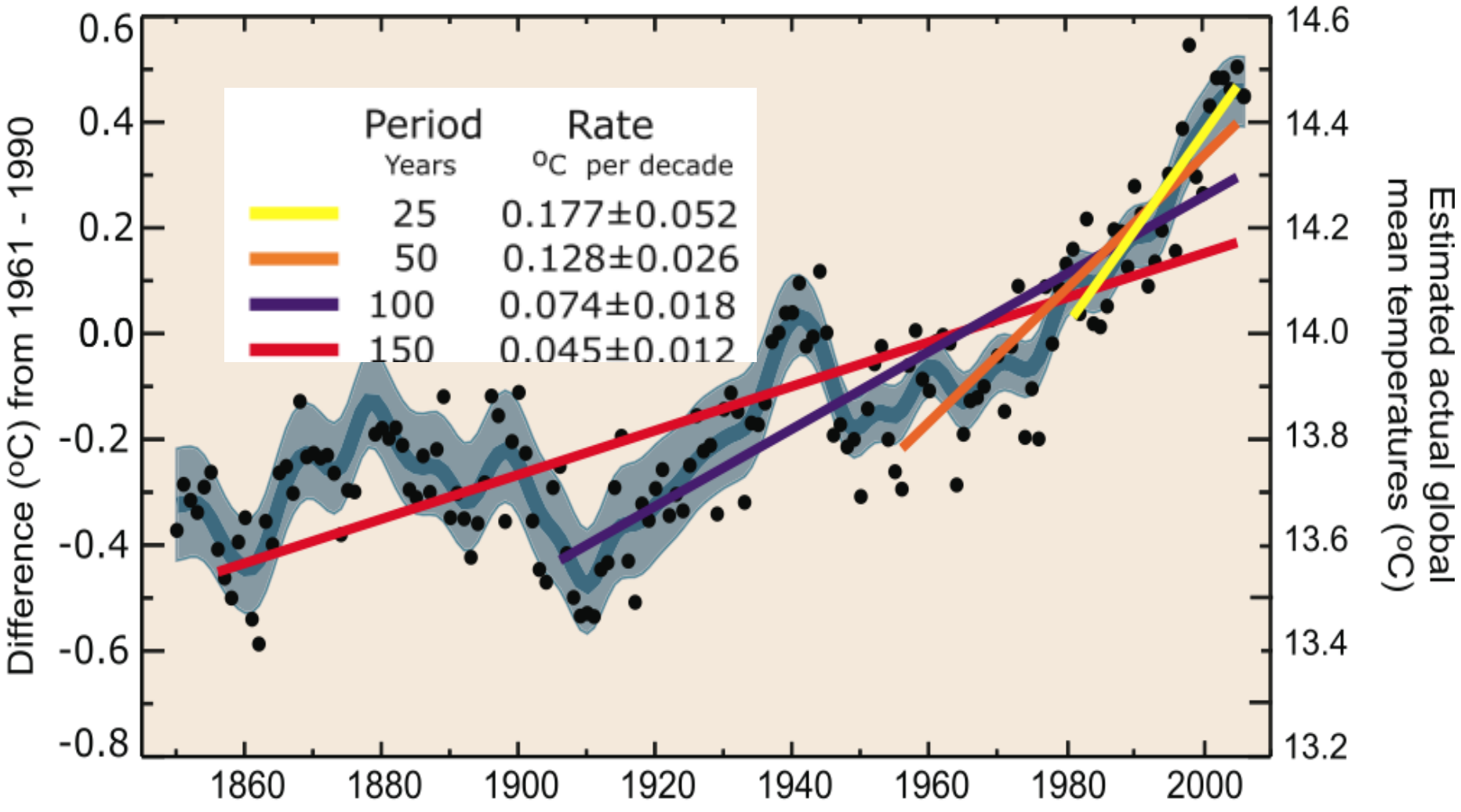


Recent Changes in CO_2 and Temperature



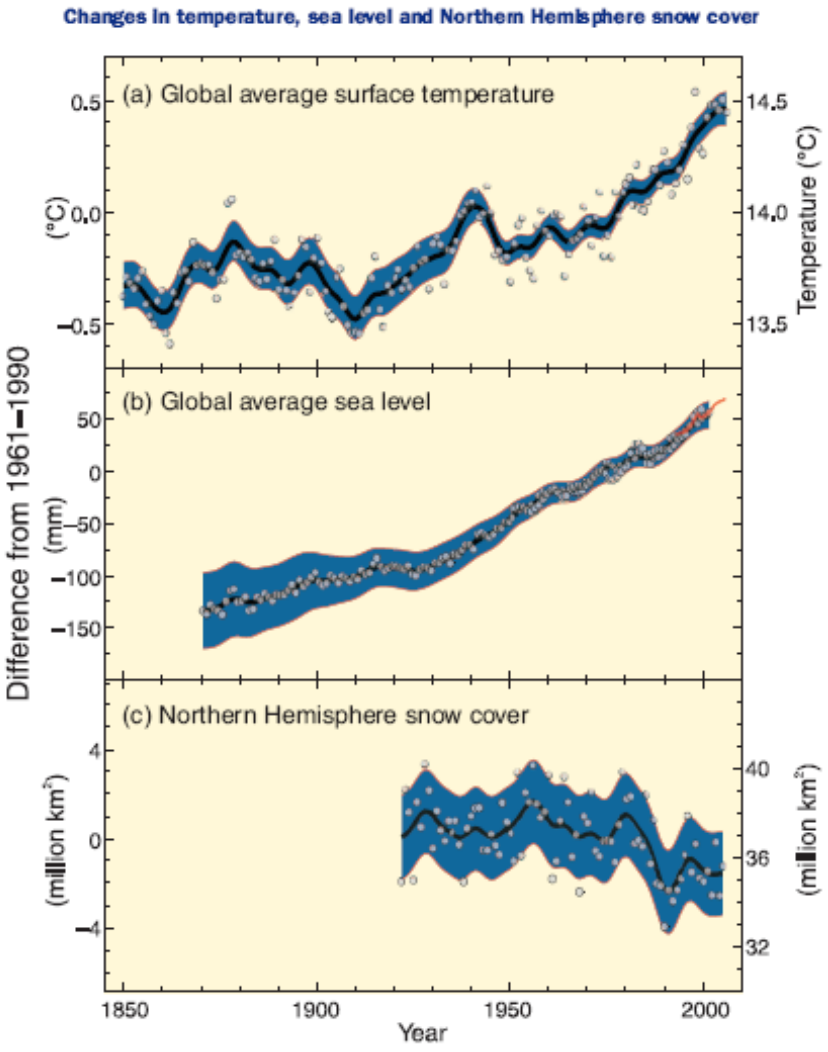
Source: Graphs by Robert Simmon, based on carbon dioxide data from Dr. Pieter Tans, NOAA/ESRL and temperature data from NASA Goddard Institute for Space Studies

The Rate of Temperature Change is Increasing



Source: Katharine Hayhoe, National Climate Change Wildlife Center (NCCWSC) The National Conference Center, Lansdowne, VA Plenary, December 3, 2008

From global warming to climate change

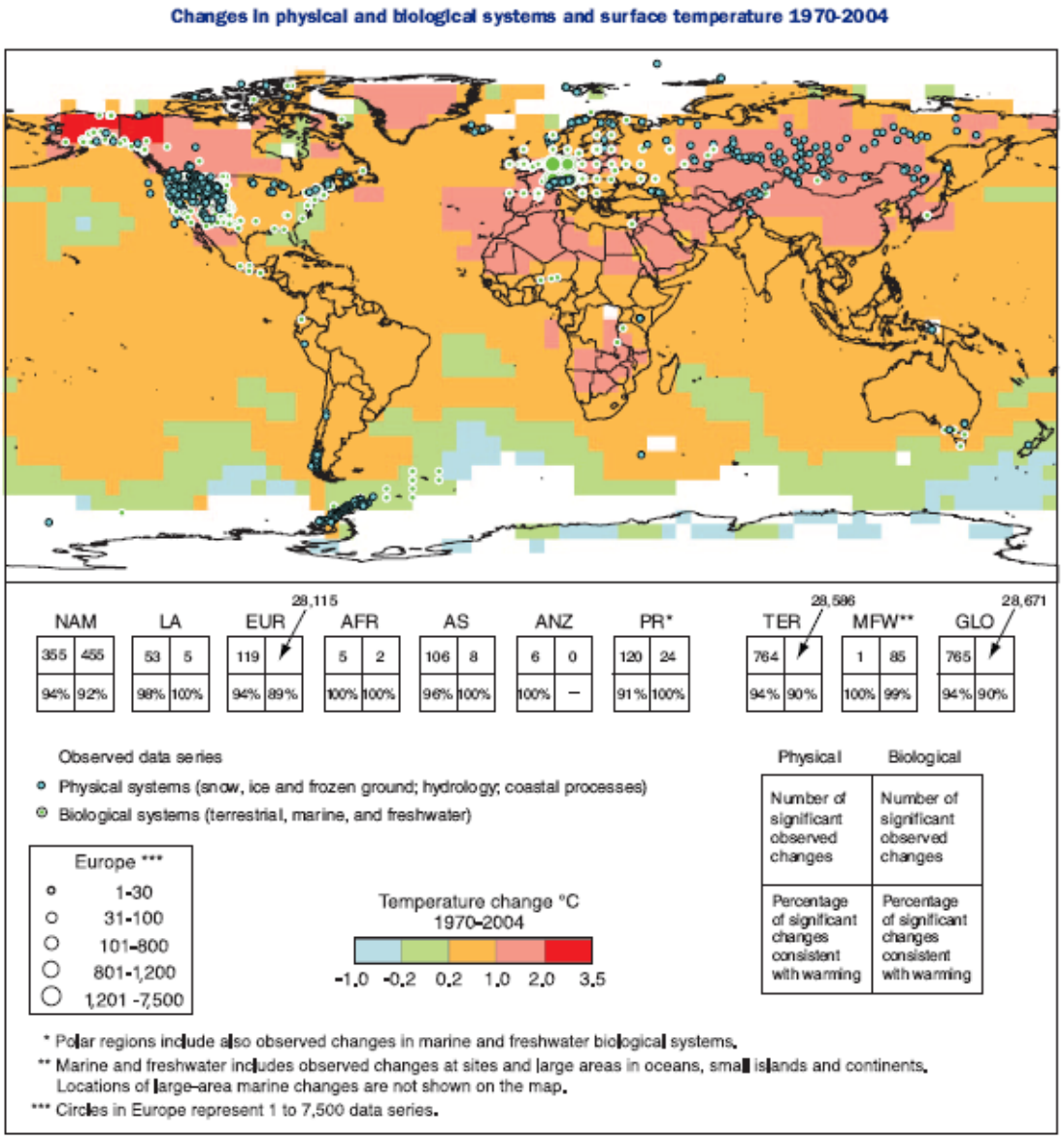


Source: An Assessment of the Intergovernmental Panel on Climate Change
This summary, approved in detail at IPCC Plenary XXVII (Valencia, Spain, 12-17 November 2007), represents the formally agreed statement of the IPCC concerning key findings and uncertainties contained in the Working Group contributions to the Fourth Assessment Report. http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf

Predicted Global Climate Impacts

- **Temperatures**: Increase by 1.8 - 4^{o} C
- **Water**
  Availability: 10-40%↑ in high latitudes; 10-30%↓ dry regions
  Precipitation: ↑ Heavy rain events
  Drought: Vast desertification of African continent
- **Sea Level**: Increase by 7-14 inches; **coastal inundation**: Low lying areas such as the Nile, the Ganges-Brahmaputra delta, small islands
- **Arctic sea ice extent**: Ice-free summers likely within a few years
- **Biodiversity**: 20 – 30% of assessed plant and animal species face elevated risk of extinction
- **Public Health**: longer transmission seasons and range of vector-borne diseases; ↑ malnutrition,

From Global Climate Change to Regional Impacts



Source: An Assessment of the Intergovernmental Panel on Climate Change; This summary, approved in detail at IPCC Plenary XXVII (Valencia, Spain, 12-17 November 2007), represents the formally agreed statement of the IPCC concerning key findings and uncertainties contained in the Working Group contributions to the Fourth Assessment Report. http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf

Observed Northeast Climate Change Impacts

- Annual temperatures across the Northeast warmed almost 2°F since 1970
- Winters warming at 1.3°F per decade since 1970
- Winter snowpack is decreasing
- Plants are flowering earlier in the spring
- Extreme heat in summer is becoming more frequent

Predicted Northeast Climate Change Impacts

Parameter	Current (1961-1990)	Predicted Range of change by 2100
Temperature (^{o} C)	7.8	10 to 13
Precipitation (cms)	102.9	108 to 117
Sea level rise (inches)	3.1	10 to 35
Streamflow-spring peak flow (days)	84.5	80 to 72
Short Droughts (#/30 yrs)	12.61	16 to 23
Snow Days/Mnth (days)	5.2	4 to 1
Length of growing season (days)	184	196 to 227

Source: Wake et al., 2006

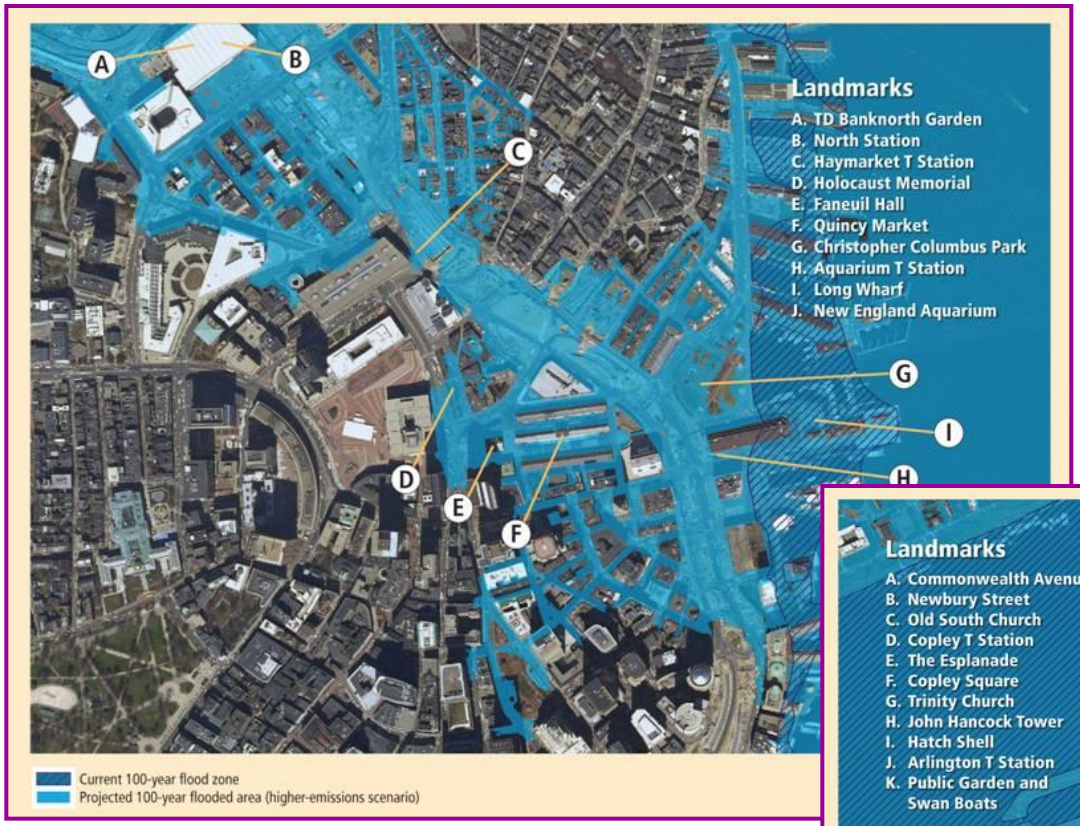
Source: Hayhoe et al., 2006. Changes in NE climate and hydrological indicators

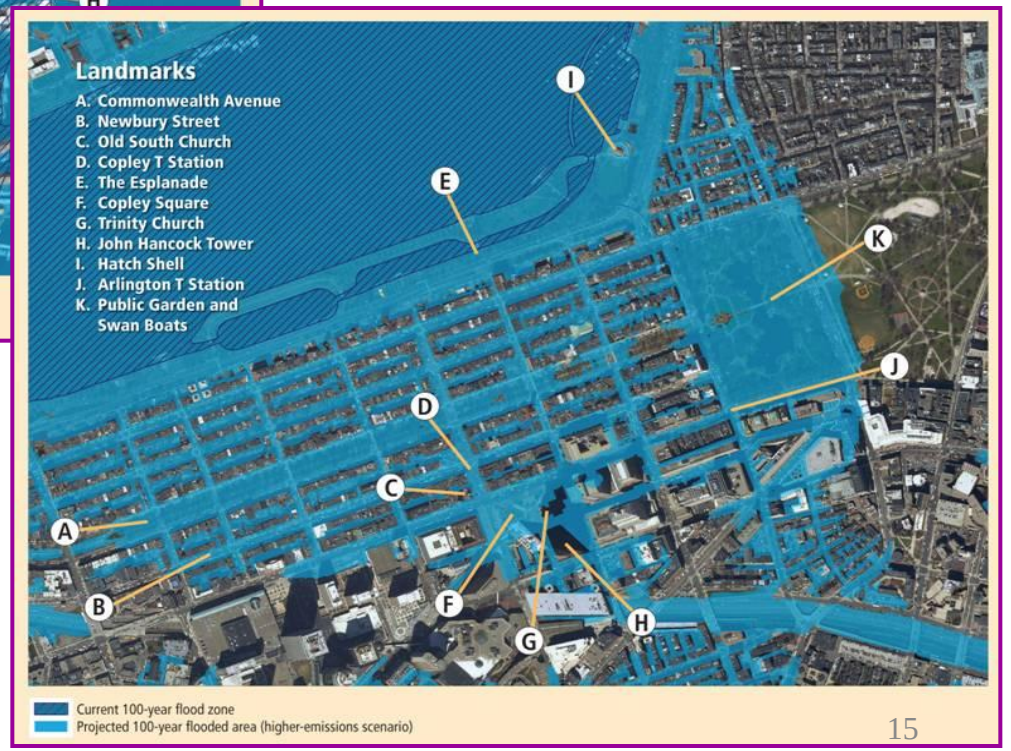
Example: Water

- Alter the timing and amount of streamflow due to reduced snowpack
- Increase winter precipitation as rain
- Increase the frequency of short-term droughts
- Warmer water temperatures – less dissolved oxygen
- Increase the frequency of extremely hot days and subsequent water demand
- Increase the likelihood and size of damaging rainstorms
- Significant erosion and damage due to storm surge

Source: Paul Kirshen

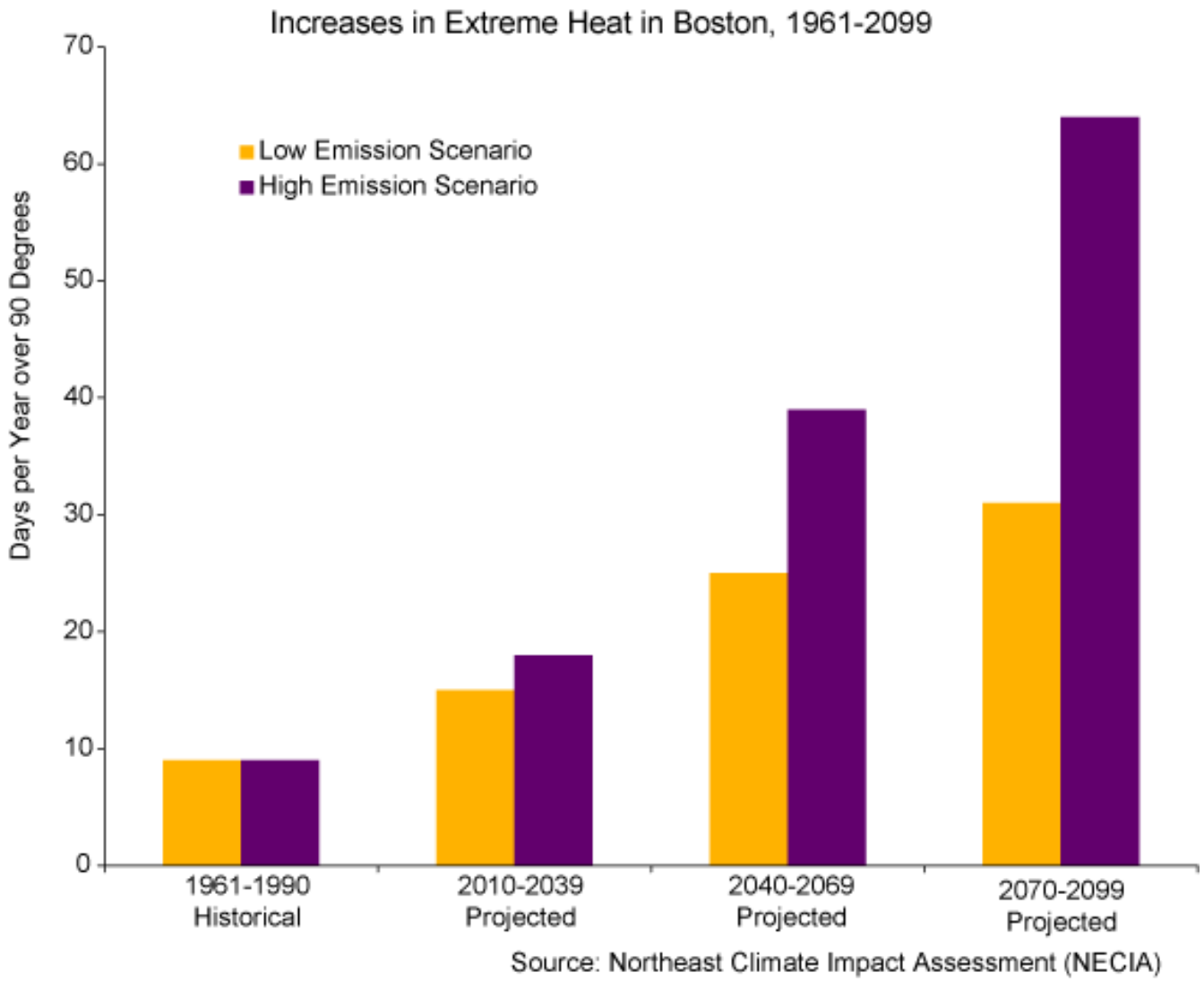
Example: Potential Coastal Flooding





Source: Kirshen et al., 2007. Coastal Flooding in the Northeastern United States due to Climate Change

Example: Extreme Heat Days



Examples: Forests, Fisheries, Agriculture, Tourism, Health

- Populations of maple, beech and birch shift 350-500 miles north
- Lobster & cod populations shift towards northern Gulf of Maine
- Insect and tree diseases flourish in warmer temperatures
- Greater infectious and vector-borne diseases, especially in vulnerable populations
- More weeds and pests affecting agriculture
- Increased impact on tourism, including seaside infrastructure and properties, winter snow related activities

Adaptation Subcommittees

- Local Economy
- Natural Resources and Habitat
- Human Health and Welfare
- Key Infrastructure
- Coastal Zone and Oceans

Scope of Analysis

- Define and assess potential vulnerabilities due to predicted impacts of climate change

- Identify possible strategies to build resilience or encourage adaptation to predicted impacts of climate change, including analysis of costs, benefits, challenges, interaction with mitigation strategies, and possible green economy impacts.

Discussion

- Where are we most vulnerable with respect to climate change?
- What strategies could help us meet the challenges of a changing climate?
- Where are the overlaps between sectors and strategies – both complementing and conflicting?
- How do we address risk and uncertainty?